GDC Embolization of Intracranial Aneurysms with SAH and Mass Effect by Subdural Haematoma

A Case Report and Review

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Key words: subarachnoid haemorrhage (SAH), subdural haematoma (SDH), cerebral aneurysm, embolization

Summary

A 43-year-old woman was brought to the emergency room due to the sudden onset of severe headache and stuporous consciousness. She had no history of head injury. Computerized tomography scan revealed subarachnoid haemorrhage and left SDH with midline shift of about 10 mm. Cerebral angiography demonstrated anterior communicating artery and right middle cerebral artery bifurcation aneurysms. Her family refused operation due to her religion never to permit blood transfusion. So just aneurysm coiling and medical ICP control was planned. Guglielmi detachable coil (GDCs) embolization of the two aneurysms was successfully performed. She made a neurological recovery after embolization without evacuation of the SDH. She was discharged from hospital with no neurological deficit on day 21. We report our experience of successful GDC embolization on multiple aneurysms without craniotomy even in the selected case of mass effect.

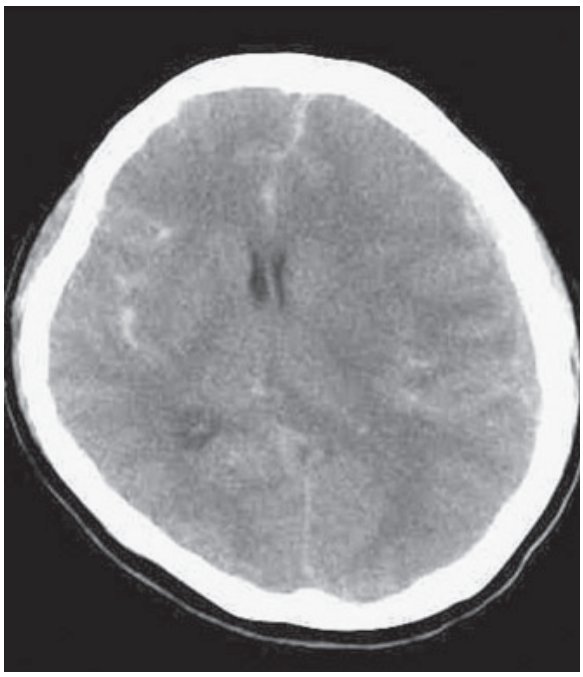
Introduction

In ruptured aneurysm, with subarachnoid haemorrhage (SAH), intracerebral haemorrhage (ICH) and intraventricular haemorrhage (IVH) are relatively common. But acute subdural haematoma (ASDH) rarely occurs. The incidence of SDH due to ruptured aneurysm is reported to be 0.5 ~ 7.9% [1-3]. Reynolds (1981), in an autopsy study, found an incidence of 10.7% in a series of 205 cases [4]. Urgent surgery for patients with ruptured aneurysm and SDH with mass effect has been strongly recommended for the purpose of aneurysm clipping and simultaneous clot removal [5]. Guglielmi Detachable Coils (GDCs) embolization of aneurysms is also an option, especially in case of multiple aneurysms or high risk aneurysms. We experienced a case of SDH by ruptured aneurysm which was successfully treated using GDC embolization without open surgery for SDH removal.

Case Report

A 43-year-old woman presented sudden onset of headache and stuporous consciousness. She had no history of head injury. The initial brain computerized tomography (CT) scan in the emergency room showed a left-sided SDH and SAH. There was 10 mm midline shift with rightward displacement of the ventricular structures (figure 1A). Cerebral angiography revealed aneurysms of the right middle cerebral artery (MCA) bifurcation (figure 1B) and the anterior communicating artery (AcomA) (figure 1C). We recommended urgent surgery for aneurysm neck clipping and decompressive

A



haematoma removal. But her family refused operation on religious grounds. So aneurysm coiling and medical ICP control were planned. Aneurysms were completely obliterated within an hour and a half after she was brought to emergency room (figure 2A). Repeated CT scan after embolization revealed markedly decreased mass effect (figure 2B). The patient made a neurological recovery without the need for surgical intervention. She was discharged home 21 days after admission without sequelae. At discharge, follow-up brain CT scan revealed no subdural haematoma and no mass effect (figure 2C).

Discussion

ASDH due to ruptured intracranial aneurysm has a poor outcome. Clarke et Al[6] reported 86% mortality in the cases. The poor outcome was associated with worse SAH grade on admission, a greater midline shift and ASDH

B

C

Figure 1 A) Initial noncontrast brain CT scan. There are hyperdense subarachnoid haemorrhage and crescentic left convexity subdural haematoma with midline shift about 10 mm. B) Right internal carotid angiography reveals aneurysm of the right middle cerebral artery bifurcation. C) Left internal carotid angiography reveals aneurysm of the anterior communicating artery.

volume [7]. They described ASDH due to ruptured intracranial aneurysms in the subdural space: by bleeding directly into the subdural space and bleeding into the subdural space via the subarachnoid space. Barton et Al[1] described four mechanisms by which blood from a leaking aneurysm could reach the subdural space.

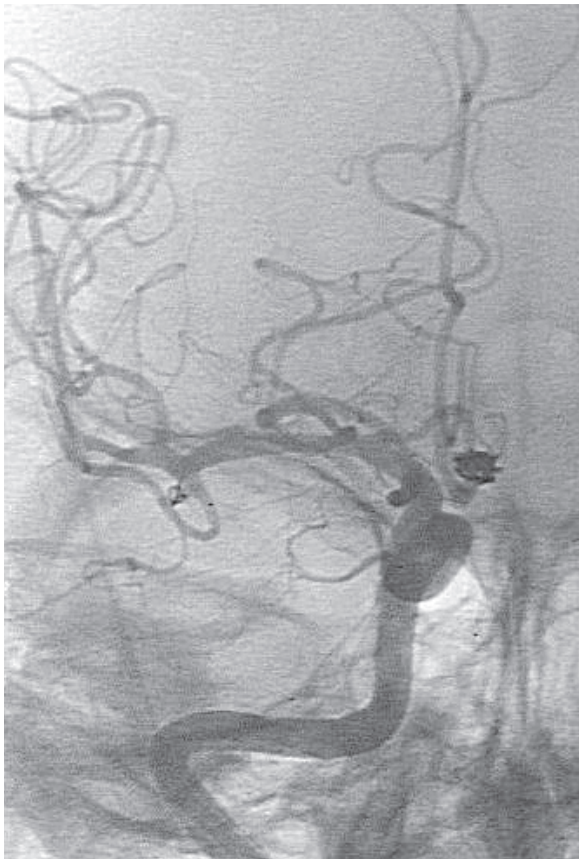
1) Successive small haemorrhages allow adhesions to develop, and the final rupture will occur into the subdural space.

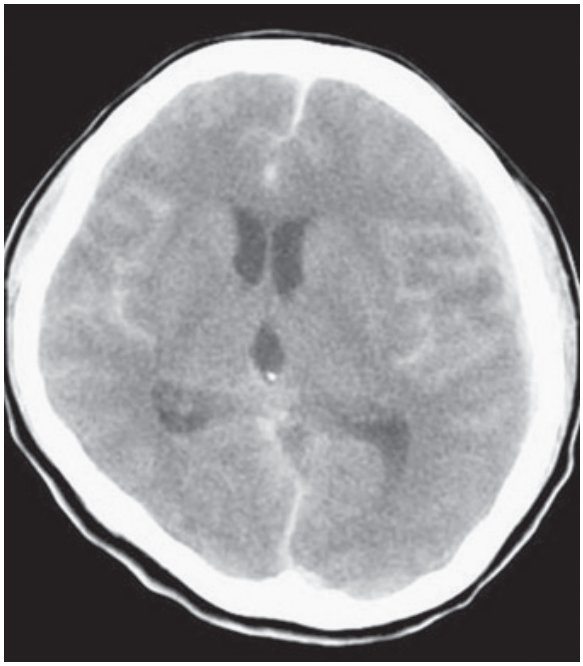
2) The arachnoid membrane may be ruptured by the rapid accumulation of blood under pressure from the leaking aneurysm.

3) A massive intracranial haemorrhage may rupture through the cortex and lacerate the arachnoid membrane.

4) An aneurysm in the part of the carotid within the subdural space may rupture and directly cause SDH.

Strang et Al[3] proposed the aneurysm may lie within the subarachnoid space, part of its surface being contact with the inner surface of the arachnoid membrane, which may, as the result of previous leakage of the aneurysm and the development of adhesions, come to form part of the sac wall. Rupture may then occur directly into the subdural space. Novak et Al[8] explain a previous minor haemorrhage may have cau-





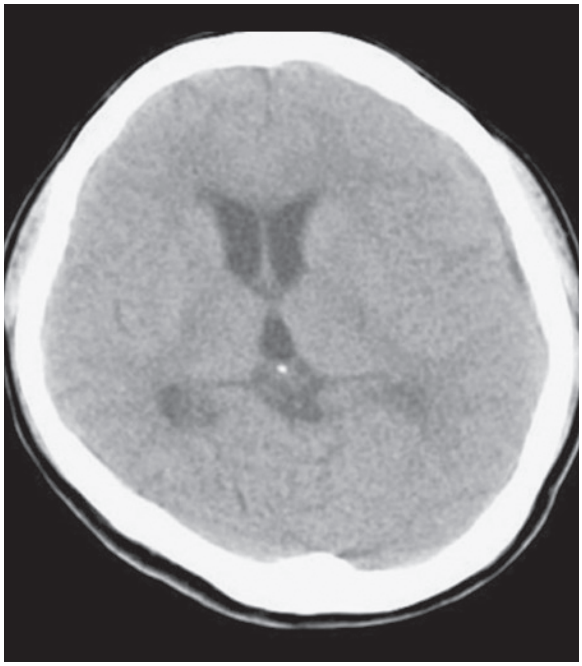


Figure 2 A) Right internal carotid angiography shows complete occlusion of anterior communicating artery and right middle cerebral artery aneurysms. B,C) CT scan reveals markedly decreased mass effect after embolization and no mass effect without subdural haematoma at discharge.

sed a thickening of the arachnoid obliterating the arachnoid space. A bleed under high pressure may cause even the rupture of the arachnoid membrane jetting blood directly into the subdural space.

Kondziolka et Al [9] reported the case which demonstrated marked arachnoid thickening adherent to the dome of the aneurysm. This may have resulted in local obliteration of the true subdural space in the region of the aneurysm. McLaughlin et Al [10] reported their case that MR imaging demonstrates the SDH originating from the dome of the aneurysm and projecting into the middle fossa.

The incidence of SDH due to ruptured aneurysm is reported to be 0.5 ~ 7.9% [1-3]. Reynolds (1981), in an autopsy study, found an incidence of 10.7% in a series of 205 cases [4]. Clincal series include those of Strang (1961) 0.5% - 420 cases, Barton (1982) 1.3% - 839, Weir (1984) 2.0% - 897, Kamiya (1991) 3.1% - 484, Novak (1995) 1.7% - 292, Inamasu (2002) 1.9% - 641 (table 1).

Aneurysms at varying sites have been implicated in SDH [11-13]. The rupture of distal anterior cerebral artery (ACA) or AcomA aneurysm is rare. On the other hand, rupture of internal cerebral artery (ICA) and MCA aneurysms are common [3,11]. Strang et Al [3] noted the location of the ruptured aneurysm; the site was MCA in 27%, ACA in 17%, vertebrobasilar artery in 3%. Barton et Al [1] found an ICA aneurysm in 55% of cases, MCA in 36%, and ACA in 9%. In contrast to previous studies, our patient had multiple aneurysms of AcomA and MCA. We supposed that the ruptured portion came from the AcomA aneurysm, following the algorithm to predict which aneurysm bled [14]:

1) use the presence of focal haemorrhage on CT to determine the site of rupture from among the known sites of aneurysms;

2) look for uncommon but highly reliable angiographic sign, such as focal mass effect and focal spasm;

3) observe size and shape; consider the more irregular, larger aneurysm; look for the presence of a nipple;

4) use clinical sign (focal deficit, localized pain, cranial nerve palsy) to help localize side or site.

In the acute period, urgent operation (aneurysmal clipping and clot removal) have been reported to be a good prognosis even in grade V patients [6,11]. For clipping of some aneurysms, brain must be retracted. In the swollen brain due to SAH with ASDH, retraction injury of brain may produce poor results. GDC embolization can exclude brain retraction injury and decrease the hospital and intensive care unit stay and hospital charges [15]. Another study regarded cerebral angiography as time-consuming diagnostic method and may even be dangerous to the poor grade patients [16]. But we considered that emergent cerebral angiography and GDC embolization may decrease the risk of life threatening re-rupture of aneurysm. As soon as the patient arrived at our emergency room, cerebral angiography with simultaneous GDC embolization has been performed and the whole procedure took an hours and a half in our hos-

Table 1 **The incidence of ASDH due to aneurysmal rupture**

	Year	ASDH due to Aneurysmal rupture	Incidence	Aneurysmal rupture
Bassett & Lemmen	1952	5	7.9%	63
Strang	1961	2	0.5%	420
Barton	1982	11	1.3%	839
Weir	1984	18	2.0%	897
Kamiya	1991	15	3.1%	484
Novak	1995	5	1.7%	292
Inamasu	2002	12	1.9%	641

ASDH: acute subdural haematoma

pital. ASDH removal after GDC embolization was considered as an alternative management strategy. In our case, the patient in grade IV underwent GDC embolization without emergent haematoma removal and was discharged from the hospital with no neurological deficit.

ASDH is a neurosurgical emergency. In ASDH, haematoma evacuation via a craniotomy is indicated in those who present with consciousness disturbance and/or brain shifting of more than 5mm on a CT scan [17,18]. Our case required urgent operation but her family refused it due to her religion. So we changed the plan for aneurysm coiling and medical ICP control. Rapid spontaneous resolution of ASDH has been rarely reported, but some cases showed prompt neurological improvement without surgical intervention. The mechanism of rapid spontaneous resolution of acute subdural haematoma include: [17]

– mannitolization that would reduce brain swelling and provide enough space to the redistribution of the haematoma.

– washing out of the haematoma by cerebrospinal fluid (CSF) through the torn arachnoid membrane. Rapid SDH resolution depends on the participation of CSF and the presence of a wide subdural space in which the haematoma can be redistributed [19,20].

Conclusions

The authors report the good outcome of GDC embolization without open surgery for patient with SDH due to ruptured intracranial aneurysm.

GDC embolization can be a good treatment option for multiple ruptured aneurysms in selected patients even when mass effect by SDH has been found.

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